DEPARTMENT OF THE INTERIOR WEATHER PROGRAMS

The Department of the Interior's (DOI) Atmospheric Science activities are primarily research and historically have been reported through the Subcommittee for Atmospheric Research; however, budgetary information for the Bureau of Land Management's operational wildfire weather data collection system is reported in this Federal Plan. The narrative below describes the full range of meteorological activity in the Interior Department.

Bureau of Land Management (BLM)

BLM is one of five Federal Land Management agencies which have centralized wildland fire weather operations in the National Interagency Fire Center (NIFC) at Boise, Idaho. BLM's Initial Attack Management System (IAMS) was designed in the mid-1980's to provide real-time data access and modeling for the fire management organization. The IAMS required a considerable dedicated telecommunications network for data distribution. In an effort to reduce these inherent telecommunications costs, the BLM has moved into a "file server" environment. This new system is called the BLM Wildland Fire Management Information Site (WFMIS) (*www.nifc.blm.gov*). Many of the capabilities that were centrally located in the old IAMS have been moved to other web sites.

The principal WFMIS inputs remain the same with Remote Automatic Weather Station (RAWS) and National Lightning Detection Network (NLDN) information. Additional fire management information is summarized and made available at the Western Regional Climate Center (WRCC) (*www.wrcc.sage.dri.edu)* and the United States Forest Service Wildland Fire Assessment System (WFAS) (*svinet2.fs.fed.us/land/wfas/*).

The BLM's RAWS program primarily collects meteorological data for fire weather forecasting. In past years, the network also provided considerable support to non-fire entities and was operated year around. However, with increased pressure on operational dollars, the BLM Office of Fire and Aviation Management has decided to restructure its network. Plans were to reduce the fire network by about one fourth in the western states. However, after considerable study, and optimization, actual reductions have been about 15 percent.

With continued funding pressures, the requirement to replace aging equipment, and the considerable costs associated with maintaining such a large network, BLM's Fire Management's strategy was to reduce the total number of RAWS, move to a single station classification (all stations configured the same), operate only during the traditional western fire season (RAWS no longer maintained in winter months), and to use any savings in operating funds to replace aging equipment and upgrade the remaining network. However, the expanded use of Fire Management RAWS data sets by other non-fire users has generated funding to permit year around operation of the entire network. The BLM's Resource Management and Oregon O&C (West-Side) RAWS networks will continue to operate and to be supported as in the past. These networks are much smaller and have specific program requirements that differ from fire management.

In 1997, the BLM began contracting with a private vendor via the NWS for lightning location data . Data is received at the NIFC in Boise, Idaho and placed on the BLM WFMIS for qualified user access. Current plans are to continue the operation of the Alaska Automated Lightning Detection System as an independent government-owed and operated system.

The BLM's Remote Sensing Fire Weather Unit at NIFC provides a full range of specialized management, maintenance, data, and support services for the BLM and numerous other Government agencies. This interagency staffed and funded facility performs work under long-term interagency agreements with those agencies within the government having similar equipment and requirements. Staffing levels within this Group are being adjusted to meet the overall interagency requirements.

In addition to the meteorological monitoring BLM conducts primarily to support Wildland fire management activities, the BLM also conducts site-specific climate monitoring at over 200 locations on the Public Lands in the eleven western states and Alaska. The operation of these sites ranges from seasonal to annual measurements of precipitation.

temperature, soil moisture and other meteorological parameters necessary to assess local climatic influences. These data are primarily used for natural resources management and planning at the local level.

In 1991, the BLM Global Change Research Program established five monitoring sites in BLM wilderness and wilderness study areas to establish baseline conditions for assessment of long term ecosystem trends. A total of 20 sites are planned to be established over the initial 5-year period. A standardized monitoring platform will be operated at these sites to include measurements of climate and atmospheric chemistry.

National Park Service (NPS)

The Park Service monitors air quality and visibility in several national parks and monuments. Gaseous pollutants data are collected on continuous and integrated (24-hour) bases. Surface meteorological data are collected and analyzed for hourly averages. Precipitation chemistry is determined on week-long integrated rainfall samples. Twenty-four hour, average particle concentrations (mass, elemental analyses, some chemical constituent analyses) are measured twice weekly. Atmospheric light extinction is measured continuously and relayed to a central location for analyses.

The NPS also conducts and contracts research to develop and test air quality models to assess long-range transport, chemical transformation, and deposition of air pollutants. These models are used to estimate source contributions to, and to identify source regions responsible for, observed pollutant loadings.

U.S. Geological Survey (USGS or Survey)

The Survey's Water Resources Division (WRD) collects streamflow, precipitation, and other climatological data for a number of projects concerning rainfall/runoff, water quality and hydrologic processes. Currently, the Geological Survey collects hydrometeorological data from approximately 4,500 remote data collection platforms. The data are transmitted to Wallops, Virginia, via GOES and rebroadcast to a domestic communication satellite (DOMSAT). Data are received from the DOMSAT by local readout ground stations (LRGS) procured by the Geological Survey under a 1992 contract. The Survey currently operates 12 LRGS' which provide near-real-time data to the Survey's computerized National Water Information System.

USGS/WRD is also helping the NWS calibrate the NEXRAD weather radar for precipitation analysis. WRD is operating 36 rainfall collection data sites in the Susquehanna River Basin which provide hourly updates of precipitation. This pilot program will continue through the end of calendar year 1998 with the objective of identifying procedures for data collection and exchange, and developing a model local agreement that can be used by other NWS/USGS Offices in an operational program.

The Survey's Geologic Division, through the National Geomagnetic Information Center (NGIC) in Golden, Colorado, collects data on temporal variations of the Earth's magnetic field from a global network of over 70 geomagnetic observatories. These observatories (which include 13 operated directly by USGS/NGIC) all belong to the INTERMAGNET program. Under INTERMAGNET, data from a global network of geomagnetic observatories are transmitted in near-real-time via satellites and computer links (E-mail) to collection and dissemination points called Geomagnetic Information Nodes (GIN's). Five GIN's are now located in Europe, North America, and Asia.

Magnetic field data are key inputs to the National Space Environment Forecast and Warning Program, which is coordinated by the OFCM, and to the new inter-agency National Space Weather Program. These data are used for nowcasting, forecasting, and modeling of "space weather" -- particularly the effects of geomagnetic disturbances. These effects range from: satellite computer upsets and early re-entry, to disruption of radio communications, to degradation of navigation systems (such as GPS), and to outages of power distribution grids. The roles and responsibilities of agencies participating in the National Space Environment and Warning Program are detailed in the "*National Plan for Space Environment Services and Supporting Research, 1993-1997*" (FCMP10-1993) which was prepared by the OFCM Committee for Space Environment Forecasting.

The Survey is continuing a joint research program with NASA and USDA to map snowpack water equivalent using satellite passive microwave techniques. The satellite observations are being compared to snowpack water equivalent data from a variety of sources: USDA's NRCS automatic SNOTEL sites; grain size and water equivalent data collected by Survey field teams; and measurements and model estimates by the NOAA National

Operational Hydrological Remote Sensing Center (NOHRSC). The object of the program is to develop algorithms for making near real-time assessments of snowpack water equivalent and extent from space to be used operationally by water resource management agencies in the western United States.

As part of its glaciology program, the Survey maintains a benchmark program on three benchmark glaciers representative of different climatic zones of the western United States, one in Washington, one on the south coast of Alaska and one in the interior of Alaska. At each glacier, the program measures the winter snow accumulation, summer snow and ice ablation, air temperature, and runoff in the glacier basin. Analysis of this 36 year long record is providing a greater understanding of the climate variability and its effects on water resources of the western United States.

The Survey participates in the Committee on Volcanic Ash of the OFCM. This committee is preparing the OFCM National Plan for Volcanic Ash. This committee is preparing the National Plan for Volcanic Ash and Aviation Safety. Through its Volcanic Hazards Program, the Survey is responsible for monitoring volcanoes in the United States; of the approximately 56 historically active volcanoes in the United States, 44 are in Alaska. Until the past decade, the Alaskan volcanoes have been largely unstudied. Despite the low population density of much of the state, Alaska's volcanoes underlie the heavily traveled air routes of the North Pacific region.

The OFCM Committee on Volcanic Ash has supported expansion of Survey monitoring activities in the remote Aleutian chain of explosive volcanoes. During FY 1996, Survey and the Alaskan Volcano Observatory (AVO) expanded its network of real-time seismic monitoring stations to 4 additional volcanoes in the Eastern Aleutian Islands and the Western Alaskan Peninsula regions of Alaska. This brings to 10 the number of volcanoes under continuous, real-time surveillance by the AVO. Data and information from the AVO monitoring activities are integrated directly into the regional operational activities of the Federal Aviation Administration (FAA), Department of Defense (DOD), and NWS to provide warnings for pilots and aircraft operators in the Alaskan region.

The Survey also carries out research in past climate change, regional hydrology, the carbon cycle, coastal erosion, volcanic activity, and glaciology. The Survey collects precipitation samples in a number of studies for the determination of atmospheric contribution to the chemical constituent loads to runoff, and for defining the effect of atmospheric deposition on water quality and the aquatic environment.

Bureau of Reclamation

Reclamation activities requiring the collection and use of meteorological data include water scheduling, flood hydrology, irrigation project management, and reservoir operations, as well as projects related to hydroelectric energy resources. One example of this is the Agricultural Water Resources Decision Support (AWARDS) system which integrates high-resolution NEXRAD radar rainfall estimates, surface environmental data, crop models, and quantitative precipitation forecasts, with watershed reservoir-canal systems and irrigation district water distribution systems. AWARDS provides operational support for: (1) early warnings to reduce hydrologic risk for loss of property and lives, (2) improved efficiency in canal and reservoir operations, and (3) improved efficiency in irrigation scheduling for water conservation and water quality.

Reclamation continues to develop a prototype Snow Accumulation Algorithm (SAA) for the recently installed national network of about 160 Doppler weather radars. This development is a cooperative effort with primary support from the tri-agency WSR-88D Operational Support Facility in Norman, Oklahoma. The prototype SAA has been successfully field tested in real-time at the Albany, New York, Cleveland, Ohio, and Minneapolis, Minnesota, NWS' Weather Forecast Offices. The SAA continues to be improved with data sets from all climatic regions in the nation which have frequent snowfall.

Reclamation's NEXRAD research team is also conducting cooperative work with NOAA's GEWEX Continental-Scale International Program (GCIP). (GEWEX is the acronym for the Global Energy and Water Cycle Experiment, part of the World Climate Research Program.) This work involves developing a correction scheme for known SAA snowfall underestimation at far range caused by the curvature of the earth and the vertical profile of radar reflectivity. Reflectivity during snowfall has maximum values near the ground. In addition, Reclamation and GCIP are cooperating on providing SAA snow water equivalent (SWE) estimates to NOAA's NOHRSC which will incorporate them into

their overall scheme of SWE and snow cover mapping for the nation. These spatial snow distributions are used by NWS River Forecast Centers (RFC) and other agencies as input to runoff and streamflow models. Therefore, improved knowledge of SWE and snow cover distributions, resulting from including NEXRAD radar estimates, will provide more accurate steamflow forecasts. Improved forecasting will, in turn, allow better management of water resources.

Reclamation meteorologists are working on modifying their snow accumulation algorithm into a Rain Accumulation Algorithm (RAA). This will provide a means of real-time estimation of rain volumes and rates over areas of particular interest. For example, Reclamation water managers need real-time warnings concerning flash flooding into reservoirs for which dam safety is a concern. Another example is accurate estimation of rainfall onto irrigation districts as part of the AWARDS system discussed earlier.

Multi-agency work on projecting potential effects of climate change and climate variability on western water resources and Bureau operations is continuing under collaborative work with the GCIP with NOAA's Office of Global Programs, and the National Centers for Environmental Prediction (NCEP). The NWS RFCs provide detailed streamflow forecasts for Reclamation's operations. Of note is technology transfer effort in the Central Valley Operations Office in Sacramento, California, where a direct workstation link to the NWS River Forecast System and other hydrometeorological forecast products will provide Reclamation's water managers access to detailed products of immediate value to water management operations.

A Technology Advancement study in collaboration with NCEP and the National Center for Atmospheric Research (NCAR) are examining the utility of mesoscale models for simulation and prediction of extreme precipitation events. These modeling efforts are taking current technologies and applying them to very heavy precipitation events to determine maximum precipitation and better understand limits of extreme precipitation in watersheds above Reclamation facilities for safety of dams studies and early warning applications.

Currently, Reclamation's HYDROMET system collects data from approximately 400 hydrometeorological data collection platforms (DCPs) which transmit data in the "real-time" through the GOES to the Bureau's DRGS in Boise, Idaho. AGRIMET is another network of 60 DCPs dedicated to analysis of crop water use and water conservation in the Pacific Northwest. Data collected and products created in Boise are electronically transferred to other Bureau, Federal and state offices. Funding for Reclamation's Global Change Response Program ended in the mid-1990s. Reclamation's weather modification research program has not been funded since 1989 except for reimbursable work.

Minerals Management Service

The Minerals Management Service's Environmental Studies Program gathers offshore environmental data in support of mineral leasing responsibilities. Currently, the Service supports five data buoys which transmit via NOAA satellites from offshore. Wind data are used in the Service's Oil Spill Risk Analysis Model to predict effects of potential spills.

MMS also is collecting meteorological and air quality data within the Breton National Wildlife Refuge, off Louisiana. The data are collected for the purpose of assessing air quality impacts from pollutant sources on the OCS. From FY 1998 through FY 2000, MMS is collecting data to study the atmospheric boundary layer over the Gulf of Mexico using two radar profilers placed on offshore platforms. One is located about 6 miles off the central Louisiana coast; the other is placed in deeper waters about 130 km offshore. Also, hourly observations are transmitted to the NWS on a real-time basis to enhance their forecasting capabilities.

In addition, MMS has requested the offshore oil and gas industry to establish a network of meteorological stations within about 100 km of the Breton National Wilderness Area in Louisiana to collect data for use in air quality modeling for that area. The number of stations and the locations has not yet been established. This effort will be funded by industry and at least one year of data will be collected. Monitoring is expected to start sometime in FY 1999.

Bureau of Indian Affairs

The Bureau of Indian Affairs collects atmospheric data to evaluate potentially irrigable Indian Trust lands in the Southwest. The Bureau also shares fire weather data with other Federal agencies while participating in fire weather forecasting at NIFC.